

PROGRESS REPORT ON 2006 FRESHWATER MOLLUSK FIELDWORK IN SIERRA NEVADA NATIONAL FORESTS, CALIFORNIA

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In 2006 we received a contract, # AG-91S8-C-05-0017, U. S. D. A. Forest Service, Region 5, to survey for freshwater mollusks in the Sierra Nevada in California. The geographic scope was to extend from the north in Lassen National Forest as far south as Lake Tahoe and including Sierra Nevada portions of Lassen, Plumas, Tahoe, and Eldorado National Forests. Primary emphasis was to be on federal Forest Service public lands, although other public lands, such as State Forests, and other sites as convenient could be included.

Target species were to include *Fluminicola* (pebblesnails), *Pyrgulopsis* (springsnails) and other springsnail taxa, as well as pleurocerids in the native genus *Juga*, particularly *J. (Calibasis) acutifilosa*, and other freshwater taxa known or thought to be rare or sensitive species according to Frest & Johannes (1995) or Forest Service listings under the Clinton Forest Plan (Frest & Johannes, 1999). As is evident from the Sierra Nevada Management Plan (SNEP, 1996-1997), the freshwater mollusks of this area are poorly known. Reference to Taylor (1981) indicates that only two, *Fluminicola turbiniiformis* and *Juga (Oreobasis) nigrina*, has been reported previously. In a recent paper Lee *et al.* (2006) reported the Nevada Great Basin form *Juga interioris* from Lassen Volcanic National Park. Anatomical work by Hershler & Frest (1996) and Hershler (1999) indicated that the former taxon was likely to have a very small California Great Basin range and was unlikely to be present in the Sierra Nevada despite previous reports. Recent DNA phylogeny of *Fluminicola* species in the Upper Sacramento-Pit River systems (Hershler *et al.*, 2007) further revised the species and genus, with two major conclusions. The first was that numerous endemic taxa in this genus (in the broad sense: now known to be polyphyletic) were likely to occur in other drainages aside from the Upper Sacramento system within the genus' range, which was known to include the Sierra Nevada, albeit rarely (Taylor, 1981). Another result was further restriction of *Fluminicola turbiniiformis sensu* Taylor, much as in Hershler & Frest (1996), which was supported by the DNA results. Further work on *Juga* species, both across the known range and in the Upper Sacramento drainage, indicates a similar proliferation of endemic new taxa in this pleurocerid group and much clarifies the status and occurrence of *Juga (Oreobasis) nigrina* (Campbell, Clarke, Frest & Johannes, in prep.: see also Campbell *et al.* (2006)). It is thus very unlikely that *nigrina* s.s. occurs in the Sierra Nevada. Similarly, the same work indicates that the Lassen Volcanic National Park report of *Juga interioris* is likewise mistaken.

However, prior to our Sierra Nevada field work, searches of museum collections and databases did indicate that previous sites for both *Juga* and for *Fluminicola* have been documented in the Sierra Nevada even if species ascriptions were erroneous. A few such sites were even reported from Lassen Volcanic National Park (see Frest & Johannes, 2007a and **Table 3** herein). We conducted field work for this project primarily in September, 2007 and will conduct further such work in summer of 2008. We collected a total of 117 sites during this survey. An additional 7 sites were included from previous surveys bring the total number of sites to 124 (see **Appendix A**). Thirty-two sites were found with living *Fluminicola* populations (26%), 21 sites were noted with living *Juga* (17%), and 6 sites had both genera present. Ninety-five sites are springs and 9 are spring influenced. Six sites were collected in Lassen Volcanic National Park, 60 in Lassen National Forest, 17 in Lassen National Forest inholding, 5 in Shasta-Trinity National Forest (administered by Lassen National Forest), 24 in Plumas National Forest, 1 in Plumas National Forest inholding, 5 in Latour Demonstration State Forest, and 5 in other (see **Table 2**). All sites are included on the map constituting **Figure 1** and are shown in **Appendix B**. Most sites were springs or spring meadows. As well as collecting and preserving the freshwater mollusks, we also measured some water quality criteria (see **Table 1**) and florally and physically described the sites (APPENDIX A. Parameters measured included temperature, pH, dissolved O₂ concentration, TDS, relative current velocity, conductivity, ORP, and turbidity. In the course of our travels in this extensive scope, we had the opportunity to collect for a single day in Lassen Volcanic National Park, 9/27/2007. Collecting was facilitated by the issue of permit #LAVO-2006-SCI-0032. We collected six sites all situated in the southeastern part of the Park along the road to Drakesbad. Later that same day we collected additional sites to the E-SE outside of the Park. These Park sites are 85-90 and are described in **Appendix A** and mapped in **Appendix B** and **Figure 1** of the Lassen Volcanic National Park report (Frest & Johannes, 2007a). Water quality parameters are presented in tabular form on **Table 4** of the Lassen Volcanic National Park report (Frest & Johannes, 2007a). Three of the sites (86, 89, 90) lacked mollusks entirely: the remaining three (85, 87, 88) had either *Fluminicola* (87), *Juga* (88) or both (85) genera. The malacofauna is summarized in **Table 3** of the Lassen Volcanic National Park report (Frest & Johannes, 2007a). No other mollusks aside from these two genera were noted. Two taxa are represented, one each of *Fluminicola* and *Juga*, Both taxa are believed to represent undescribed (new) species. We were somewhat surprised to find these genera in such volcanic terrain, although the museum records lead us to believe there was a reasonable prospect.

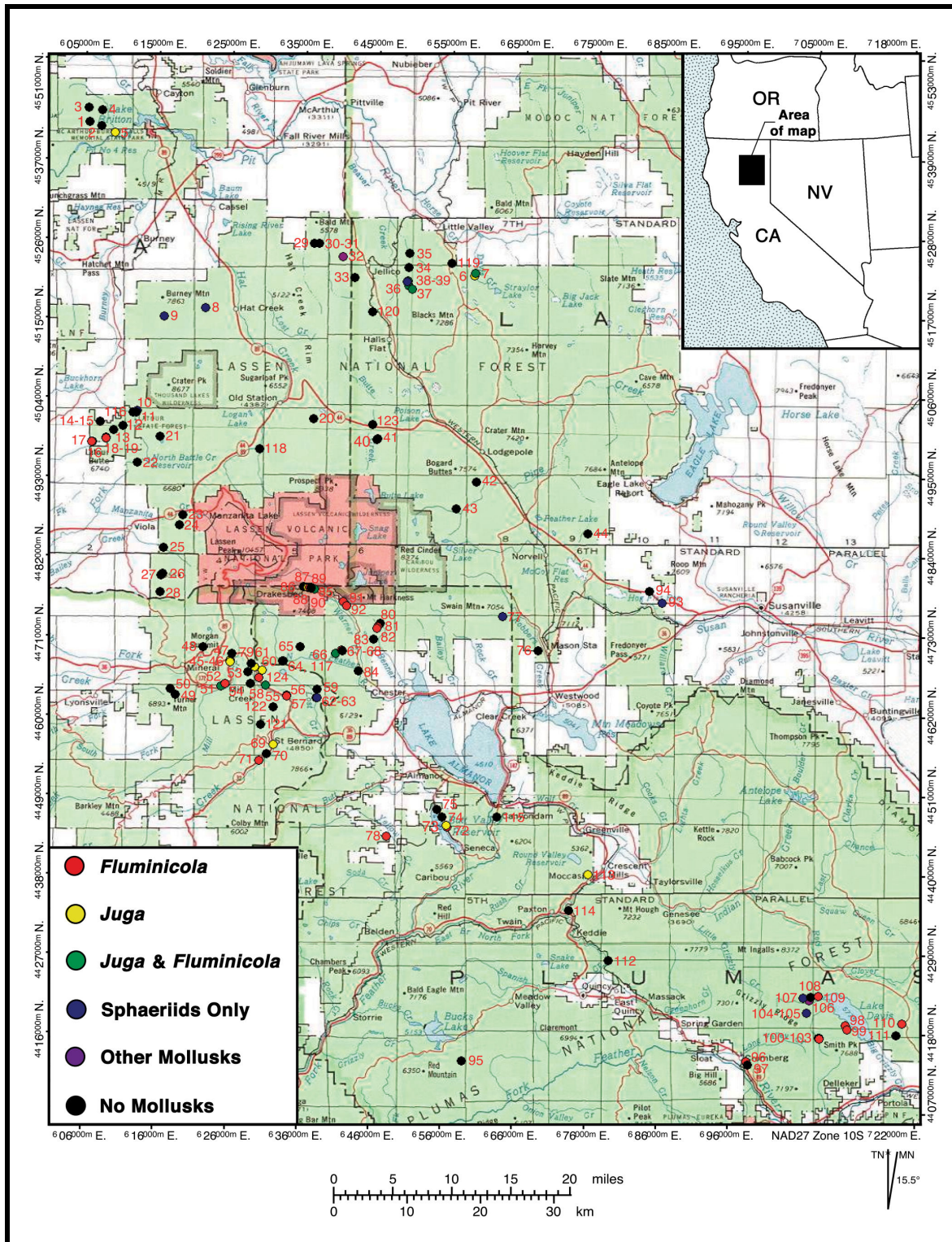


FIGURE 1. MAP OF SURVEY AREA IN NORTHERN SIERRA NEVADA. Location of numbered mollusk sites (see **Appendix A** and **Appendix B** for details) in Lassen and Plumas National Forests. Map created with TOPO!® ©2006 National Geographic.

Distribution and rarity of the new finds will have to be determined by additional field work. Indications are that the Sierra Nevada may have numerous species in both genera, as proven in the Upper Sacramento system. Adjacent sites 91 and 92 (in the same drainage as the Park sites), for example, also have *Fluminicola* or *Juga*; but these appear to be different new taxa. DNA and anatomical studies, as well as additional field work will be necessary to resolve the status of the Sierra Nevada taxa. It is likely that pleurocerids and springsnails will be absent from large areas of the Park subject to recent vulcanism, hot or sulfur springs and other hydrothermal features, or recent land slides or other major disruptive natural processes. Nevertheless, it is highly likely that additional searches of Park springs and streams, including sites indicated on museum labels, will result in location of additional species or populations of both *Juga* and *Fluminicola*, at least some of which will likely be extremely precinctive taxa.

Some areas of special potential would be Kings Creek, Grassy Swale, Hot Springs Creek (all Warner Creek tributaries), and possibly upper Willow Creek.

As well as sites in Lassen National Volcanic Park, we also concentrated on some other areas in the northern part of the Sierra Nevada, particularly Lassen National Forest and the northern parts of Plumas National Forest. 2007 field work will be concentrated mostly further south in Plumas National Forest, Eldorado National Forest, Lake Tahoe National Forest, and in the Lake Tahoe area. Because sites with *Juga* or *Fluminicola* were widely spread but not uncommon, it is not likely that we have found all sites. More intense field work in the same areas will be necessary for comprehensive coverage. We were also asked by the Forest Service to examine distribution of Sensitive freshwater mollusk species in the Lake Davis basin, including some sites previously visited by California Fish and Game personnel (see **Appendix C**). Results of this effort are summarized below and in Frest & Johannes (2007b).

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TABLE 1. Water Quality Measurements.

SITE NO.	DEIXIS LOC. NO.	DATE COLL.	H ₂ O DEPTH (cm)	H ₂ O WIDTH (m)	H ₂ O TEMP (°C)	COND (µS/cm)	pH	DO ₂ (mg/L)	TDS (ppm)	ORP (mV)	TURBIDITY	VELOCITY	Habitat/ modifications/ access/connect	Flum-inicola	Juga
1	6280	9/12/06	2	1.8	9.5	136.8	6.88	9.74	90.86	265	clear	medium	R(1)/pc3/1(gr)/c1	-	-
2*	6281	9/12/06	1	0.5	9.9	141.2	7.30	9.98	91.11	246	clear	medium	R(1)/cu2, d3/1(gr)/c1	-	-
3 ^b	6283	9/12/06	0	-	-	-	-	-	-	-	-	-	R(1)/ho/1(gr), tr/c2(dr)	-	-
4	5162	9/12/04	1-3	1.6-1.9	12.5	100.4	7.36	8.47	65.65	209	clear	medium	R(1)/d3, cu2/1(gr)/c1	-	-
5*	6284	9/13/06	1	1	15.1	130.6	7.30	6.79	83.97	179	clear	slow-medium	C(1, s?)/ho/1(gr)/c1	-	common
6	6285	9/14/06	0.3	1.3	12.9	240.4	8.06	8.19	157.5	117	clear	slow	R(1)/ho/2/c1	-	common
7	5166	9/14/06	4	-	13.9	243.4	8.89	7.86	159.7	131	clear	medium	C(2, s)/cu2/1(di)/c1	common	common
8	6286	9/15/06	48	3	14.1	198.8	7.87	4.74	130.2	130	very	nil	R(1)/pc2/1(di)/c4	-	-
9	6287	9/15/06	1-2	0.3	6.8	55.15	7.83	9.09	35.32	185	clear	slow-medium	R(1)/bx2(wo), pi2, wt2(co), cu2/1, d/c4	-	-
10*	6288	9/16/06	0.2-2	0.2-0.3	10.5	42.37	6.46	5.42	26.96	206	clear	very slow	R(1)/ho/1(gr)/c1	-	-
11*	6289	9/16/06	2	0.25	5.1	86.6	7.11	5.79	26.60	196	clear	slow-medium	R(1)/ho/1(gr)/c1	-	-
12*	6290	9/16/06	-	-	-	-	-	-	-	-	-	-	R(1)/bx1(co)/1(gr)/c1 (dr)	-	-
13*	6291	9/16/06	-	-	-	-	-	-	-	-	-	-	R(1)/bx1(co), pi1, wt1(co)/ 1(gr)/c1(dr)	-	-
14	6292	9/16/06	1	0.2	5.9	31.79	7.51	9.76	20.64	196	clear	slow-medium	R(1)/tr2(co), pi1(ab)/ 1(gr)/c1	-	-
15*	6293	9/16/06	0.2	0.15	-	-	-	-	-	-	-	slow-medium	R(1)/ho/1(gr)/c1	-	-
16	6294	9/16/06	3-12	2	7.4	112.4	7.82	10.34	71.74	203	clear	fast	R(3)/cu2/1(gr)/c1	scarce	scarce
17**	6295	9/16/06	0.3	0.25	-	-	-	-	-	-	clear	medium-fast	R(2)/d3, cu2/1(gr)/c1	scarce	-
18	6296	9/16/06	1-5	0.6	6.5	106.1	7.95	10.25	67.19	218	clear	medium-fast	R(2)/cu2/1(gr)/c1	scarce	-
19*	6297	9/16/06	1-2	0.2	6.5	109.1	7.80	10.20	64.62	207	clear	medium-fast	R(2)/cu2, d3/1(gr)/c1	scarce	-
20	6298	9/17/06	-	-	9.3	425.3	8.41	3.28	286.2	182	very	nil	R(1)/pc3, pi1, bx1(wo)/2/c4	-	-
21*	6299	9/17/06	0.1-1.5	0.15	11.1	45.06	7.55	5.44	29.12	203	clear	slow	R(1)/cu1/1(di)/c1	-	-
22	6300	9/17/06	5-14	3.8	14.0	39.98	7.49	8.01	25.59	222	clear	medium-swift	C(3)/cu3/1(gr)/c1	-	-
23	6301	9/17/06	12	3.2	13.1	104.3	8.03	8.21	66.46	211	clear	swift	C(2)/cu3/1(gr)/c1	-	-
24*	6302	9/17/06	0.3	0.15	-	-	-	-	-	-	clear	slow	R(1)/bx1(wo), pc3/1(dr)/c3	-	-
25	6303	9/17/06	20	9	9.5	69.69	7.81	9.50	44.85	211	clear	swift	C(2)/cu3/1(gr)/c1	-	-
26*	6304	9/17/06	0.5	0.4	-	-	-	-	-	-	clear	nil	R(1)/d3/1(gr)/c2	-	-
27	6305	9/17/06	9	0.5	6.2	70.04	7.74	9.70	44.80	202	clear	medium-swift	C(1, s)/cu3/1(gr)/c1	-	-
28	6306	9/17/06	10-20	4	-	-	-	-	-	-	clear	medium-swift	C(2)/cu3/1(gr)/c1	-	-
29	5620	9/18/06	1.2-12	0.5-4	11.3	140.6	7.26	3.52	90.20	186	clear	slow	R(1)/pc2/1(di)/c2	-	-
30*	6307	9/18/06	0.1	-	-	-	-	-	-	-	slightly	nil	R(1)/pc2, f4(in)/1(di)/c2	-	-
31	6308	9/18/06	1-3	0.5-1	16.8	121.5	6.97	2.28	77.98	186	clear	slow	R(1)/ho/1(di)/c2	-	-

TABLE 1. Water Quality Measurements (cont.).

SITE NO.	DEIXIS LOC. NO.	DATE COLL.	H ₂ O DEPTH (cm)	H ₂ O WIDTH (m)	H ₂ O TEMP (°C)	COND (µS/cm)	pH	DO ₂ (mg/L)	TDS (ppm)	ORP (mV)	TURBIDITY	VELOCITY	Habitat/ modifications/ access/connect	Flum-inicola	Juga
32*	5619	9/18/06	0.1-0.3	-	-	-	-	-	-	-	-	slow-medium	R(1)/bc3, f2/1(di, 4)/c2	-	-
33*	5618	9/18/06	-	-	-	-	-	-	-	-	-	-	R(1)/bx1(wo)/1(gr)/c2 (dr)	-	-
34	5172	9/18/06	-	-	-	-	-	-	-	-	clear	-	R(1)/ho/1(gr)/c2(dr)	-	-
35	5171	9/18/06	-	-	-	-	-	-	-	-	-	-	R(1)/ho/1(gr)/c2(dr)	-	-
36	5170	9/18/06	1-4	0.25	13.4	151.12	8.36	8.63	96.96	131	clear	medium-swift	R(2)/f3/1(di)/c1	common	common
37	6309	9/18/06	1-6	0.3	10.5	152.8	8.18	9.02	98.71	164	clear	medium	R(2)/cu2/1(gr)/c1	abundant	abundant
38	6310	9/18/06	1-2	0.25	12.1	154.5	8.39	8.71	98.79	167	clear	medium	R(2)/cu2/1(di)/c1	common	common
39	6311	9/18/06	1	0.2	-	-	-	-	-	-	clear	slow	R(2)/cu2/1(di)/c1	-	-
40	6312	9/19/06	10	0.9	5.7	90.50	7.99	10.23	57.99	155	clear	medium	R(2)/ho/1(di)/c2	-	-
41	6313	9/19/06	9	0.8	6.7	86.74	7.87	9.38	55.50	177	clear	slow-medium	R(2)/ho/1(di)/c2	-	-
42	6314	9/19/06	1-5	2	5.3	128.7	7.38	10.31	81.10	193	clear	medium-swift	R(2)/bx2(co), f2/1(di)/c1	-	-
43	6315	9/19/06	12	2.5	4.9	74.54	7.58	9.95	47.72	181	clear	slow-medium	R(2)/cg/1(di)/c1	-	-
44	6316	9/19/06	5	0.3	8.8	125.6	7.43	8.34	80.54	187	clear	slow	R(1)/cu2/1(gr)/c1	-	-
45*	6318	9/20/06	5-12	0.2	9.4	138.4	7.63	4.37	88.94	136	clear	slow-medium	R(2)/cu2, d3/1(pa)/c1	-	common
46*	6319	9/20/06	2-10	0.25	11.1	138.5	7.86	8.97	89.42	127	clear	medium	R(2)/cu2, d3/1(pa)/c1	-	common
47	6320	9/20/06	2-4	0.10	8.1	89.03	7.68	9.62	57.24	142	clear	medium	R(1)/cu2, bx1(wo)/1(pa)/c1	-	-
48	6321	9/20/06	3-5	0.17	8.9	87.41	7.97	9.42	47.85	136	clear	swift	R(1)/cu2/1(gr)/c1	-	-
49	6322	9/20/06	1-5	3	5.6	116.1	8.15	10.40	74.64	148	clear	medium-fast	C(1)/cu2/1(gr)/c1	-	-
50	6323	9/20/06	0.3-0.6	0.5	7.5	101.2	8.19	9.58	64.71	147	clear	medium-fast	C(1, s)/cu2/1(gr)/c1	-	-
51*	6324	9/20/06	2-10	0.5-2.5	7.5	110.7	8.15	10.01	70.52	150	clear	slow-medium	R(1)/cu2/1(gr)/c1	common	common
52*	6325	9/20/06	2-6	0.65	6.9	101.2	7.62	9.93	66.30	166	clear	medium	R(1)/cu2/1(pa)/c1	scarce	-
53	6326	9/21/06	5-7	2-3	5.1	53.48	6.94	11.03	34.43	162	clear	swift	R(2)/pc2/1(di)/c1	-	-
54	6327	9/21/06	2-5	1.5-2	5.3	37.7	7.68	10.64	24.60	152	clear	swift	R(2)/pc2, cu2/1(di)/c1	-	-
55*	5665	9/22/06	2-12	0.25	8.2	80.49	6.95	8.11	54.46	171	clear	slow-medium	R(1)/cu1, cg/1(pa)/c1	-	-
56*	5666	9/22/06	5-10	0.55	7.8	87.8	6.98	8.61	56.02	148	clear	slow	R(1)/cg/1(pa)/c1	abundant	-
57*	5667	9/22/06	40	4	10.2	60.57	7.55	8.52	38.98	145	clear	slow-medium	C(2)/br(co), cg/1(pa)/c1	-	scarce
58*	5669	9/22/06	2-4	0.12-1	8.5	80.14	6.90	9.41	51.56	152	clear	medium	R(1)/cu2/1(pa)/c1	common	scarce
59	6329	9/22/06	4	2-3	5.7	43.70	7.22	10.70	27.97	162	clear	medium	R(2)/cu2/1(gr)/c1	-	-
60	5670	9/22/06	1-6	0.6	9.2	142.9	8.22	9.64	91.70	160	clear	medium-fast	R(1)/cu2/1(gr)/c1	-	scarce
61	6331	9/23/06	14	0.55	12.0	141.5	7.87	8.14	90.36	141	clear	slow-medium	R(1)/cu2/1(pa)/c1	-	common
62	6332	9/23/06	15	5	11.6	46.94	8.05	9.75	30.16	141	clear	medium-fast	C(2,s)/cu3, cg/1(gr)/c1	-	-
63	6333	9/23/06	22	2-3	7.1	43.90	7.51	10.23	28.14	152	clear	fast	R(3)/cg/1(gr)/c1	-	-
64	6334	9/23/06	1-6	0.5	5.6	114.8	7.08	9.30	73.06	181	clear	fast	R(1)/pt2(pl)/1(gr)/c1	-	-

TABLE 1. Water Quality Measurements (cont.).

SITE NO.	DEIXIS LOC. NO.	DATE COLL.	H ₂ O DEPTH (cm)	H ₂ O WIDTH (m)	H ₂ O TEMP (°C)	COND (µS/cm)	pH	DO ₂ (mg/L)	TDS (ppm)	ORP (mV)	TURBIDITY	VELOCITY	Habitat/ modifications/ access/connect	Flum-inicola	Juga
65	6335	9/23/06	3-5	5-10	7.9	69.57	7.19	9.46	41.44	174	clear	slow	R(3)/f3, b2/1(gr)/c1(dr)	-	-
66	6328	9/23/06	12	3-5	8.8	160.8	7.39	8.98	140.0	167	clear	medium-swift	R(3)/cu2, f1/1(pa)/c1	abundant	common
67	5673	9/23/06	5-14	1-3	5.9	116.0	7.29	10.10	73.98	174	clear	medium	R(2)/cu2, d2(wo)/2(gr)/c1	common	-
68	6336	9/23/06	2-5	1-2	6.1	104.5	7.74	10.30	66.67	161	clear	medium	R(1)/cu2/2(gr)/c1	-	-
69	6337	9/24/06	2-25	9	9.5	76.18	8.15	9.94	49.14	158	clear	medium-fast	C(3)/cg/1pa/c1	-	scarce
70	6338	9/24/06	2-14	2	-	-	-	-	-	-	clear	medium	C(2)/br(co)/1(pa)/c1	-	-
71	6339	9/24/06	0.7-2	0.9	10.9	169.1	7.86	8.83	109.3	159	clear	slow-medium	R(1)/d3/1(pa)/c1	common	-
72	6340	9/24/06	0.5-2	0.9-1.5	11.3	257.4	8.30	9.13	167.2	149	clear	slow-medium	R(1)/cu2, w2(wo, ab)/1(pa)/c1	scarce-common	-
73	6341	9/24/06	1-5	0.8-1.1	10.1	137.8	8.05	9.45	88.22	141	clear	medium	C(1)/cu3/1(pa)/c1	-	common
74	6342	9/24/06	5	0.9	10.8	364.4	8.55	8.96	242.0	138	clear	medium	C(1)/cu3/1(pa)/c1	-	-
75	6343	9/24/06	2-5	1.3	-	-	-	-	-	-	clear	medium	C(1)/cu3/1(pa)/c1	-	-
76	6344	9/25/06	1-2	2-3	10.2	80.06	7.17	6.02	51.72	155	slight	slow	R(1)/pc2/2(gr)/c1	-	-
77	6345	9/25/06	1-2	0.45	6.6	50.66	7.17	9.55	32.81	161	clear	slow	R(1)/f1(ab), tr2(ab)/1(gr)/c1	-	-
78	6346	9/26/06	12	9	6.5	129.6	7.84	10.06	82.14	172	clear	medium	R(3)/ho/1(gr)/c1	abundant	-
79	6347	9/26/06	0.5-1	1	9.4	148.5	7.95	7.38	95.44	127	clear	medium	R(1)/cu2/1(pa)/c1	-	abundant
80	6348	9/26/06	15	3.8	6.7	60.43	7.90	9.34	38.68	160	clear	medium-swift	C(1, s)/cu3/1(gr)/c1	-	-
81	6349	9/26/06	2-5	0.2	4.5	61.26	7.46	10.42	39.27	160	clear	medium-swift	R(2)/d2, p12(pl), cu2/1(gr)/c1(dr)	common	-
82	6350	9/26/06	1-2	0.35	4.8	64.13	7.05	10.11	41.17	177	clear	medium	R(1)/ho/1(gr)/c1	common	-
83	6351	9/26/06	12	2	12.6	69.56	7.87	8.31	44.85	149	clear	medium	C(1)/cu3/1(gr)/c1	-	-
84	6352	9/27/06	0.12-1	18	9.8	89.75	8.10	9.13	57.51	126	clear	swift	R(1)/ho/1(gr)/c1	-	-
85*	6353	9/27/06	1-2	0.9	9.3	67.47	7.99	9.15	43.31	161	clear	medium	C(1, s)/cu3/1(gr)/c1	common	scarce
86*	6354	9/27/06	2-5	0.85	9.6	65.95	7.85	10.15	46.92	175	clear	medium	C(1, s)/cu3/1(gr)/c1	-	-
87*	6355	9/27/06	1-4	1	13.2	77.04	8.08	8.23	49.39	159	clear	medium	C(1, s)/cu3/1(gr)/c1	-	common
88*	6356	9/27/06	2-6	0.25-1	8.2	70.88	8.02	9.32	45.79	151	clear	swift	C(1, s)/cu3/1(gr)/c1	scarce	-
89**	6357	9/27/06	0.5	0.95	-	-	-	-	-	-	clear	medium-swift	C(1, s)/cu3/1(gr)/c1	-	-
90*	6358	9/27/06	1-5	0.65	9.4	70.12	8.05	9.14	46.68	158	clear	swift	C(1, s)/cu3/1(gr)/c1	-	-
91	6359	9/27/06	2-8	1.3	7.3	69.36	8.01	9.83	44.33	161	clear	swift	C(1, s)/cu3/1(pa)/c1	scarce	-
92	6360	9/27/06	3-6	1-1.4	7.6	68.59	8.00	9.17	43.95	161	clear	medium	R(2)/cu3/1(pa)/c1	common	-
93	6361	9/28/06	2-5	0.18	13.2	266.0	8.18	8.50	175.1	86	clear	slow-medium	R(1)/cu3/2(gr)/c1	-	-
94	6362	9/28/06	5-12	3-8	6.7	164.6	7.62	9.58	107.9	137	clear	medium-swift	R(2)/cu2, pc3/1(gr)/c1	-	-
95	6363	9/29/06	1-2	0.4	8.7	277.4	7.68	8.39	82.09	92	clear	slow	R(1)/cu2/1(di)/c3	-	-

TABLE 1. Water Quality Measurements (cont.).

SITE NO.	DEIXIS LOC. NO.	DATE COLL.	H ₂ O DEPTH (cm)	H ₂ O WIDTH (m)	H ₂ O TEMP (°C)	COND (µS/cm)	pH	DO ₂ (mg/L)	TDS (ppm)	ORP (mV)	TURBIDITY	VELOCITY	Habitat/ modifications/ access/connect	Flum-inicola	Juga
96	6364	9/30/06	1-2	0.4-1	11.8	244.6	7.69	8.03	159.6	126	clear	medium	R(1)/cu2, bx1(co)/1(pa)/c1	common	-
97	6366	9/30/06	-	-	-	-	-	-	-	-	-	-	C(2)/cu3/1(pa)/c2(dr)	-	-
98	6367	9/30/06	1-6	1.15	9.6	209.6	8.04	8.28	138.9	118	clear	medium	R(2)/cu2/2(gr)/c1	common	-
99	6368	9/30/06	2-4	1.4	8.0	195.2	7.72	7.50	126.2	97	clear	medium-swift	R(1)/cu2, pi2(me, ab)/1(di)/c1	common	-
100*	6369	9/30/06	0.5-1	0.3	-	-	-	-	-	-	clear	slow	R(1)/ho/1(gr)/c1	scarce	-
101	6370	9/30/06	-	-	-	-	-	-	-	-	clear	slow	R(1)/ho/1(gr)/c1	-	-
102	6371	9/30/06	-	-	-	-	-	-	-	-	clear	slow	R(1)/ho/1(gr)/c1	scarce	-
103	6372	9/30/06	-	-	-	-	-	-	-	-	clear	slow	R(1)/ho/1(gr)/c1	scarce	-
104	6373	9/30/06	2-6	0.42-1	7.7	153.4	8.06	9.08	98.87	111	clear	medium	R(2)/cu2/2(gr)/c2	-	-
105	6374	9/30/06	1-2	2	-	-	-	-	-	-	clear	slow	R(2)/cu2/1(gr)/c2	-	-
106	6375	10/1/06	60-120	2.5-3	10.2	179.1	7.83	5.25	115.7	102	clear	slow	C(2)/br(co)/1(gr)/c1	-	-
107*	6376	10/1/06	0.5-1	0.5-1	-	-	-	-	-	-	clear	medium	R(1)/cu2/1(gr)/c3	-	-
108	6377	10/1/06	-	-	-	-	-	-	-	-	clear	-	R(1)/rf/1(di)/c3	-	-
109	6378	10/1/06	1-2	0.8	9.5	176.9	7.23	7.55	113.8	104	clear	medium	R(1)/cu1/1(gr)/c3	common	-
110	6379	10/1/06	2-5	1.1	8.4	164.5	8.22	9.58	106.0	112	clear	swift	R(1)/cu2/1(gr)/c1	common	-
111	6380	10/1/06	2-3	0.95	9.4	155.1	8.18	9.24	99.44	89	clear	medium	R(1)/dr3, tr2(me)/1(gr)/c2	-	-
112	6381	10/2/06	3	1.2	10.0	276.6	8.28	7.23	180.7	96	clear	medium	C(1)/cu3/1(gr)/c1	-	-
113	6382	10/2/06	12	2	12.4	213.6	8.47	8.56	138.7	87	clear	swift	C(1)/cu3/1(gr)/c1	-	scarce
114*	6383	10/2/06	-	-	-	-	-	-	-	-	-	-	R(1)/pi1, df/1(pa)/c1(dr)	-	-
115*	6384	10/2/06	-	-	-	-	-	-	-	-	-	-	R(1)/ho/1(gr)/c2(dr)	-	-
116	6385	9/16/06	1-15	2	-	-	-	-	-	-	clear	medium	C(2)/cu3/1(gr)/c1	-	-
117*	6330	9/23/06	0.2	0.5	-	-	-	-	-	-	clear	medium	R(1)/cu2/1(gr)/c1	-	-
118*	5203	9/29/96	-	-	-	-	-	-	-	-	-	-	C(1)/br/1(gr)/c2(dr)	-	-
119*	5205	9/24/01	-	-	-	-	-	-	-	-	-	-	C(1)/cu3/1(gr)/c2(dr)	-	-
120*	5617	7/26/02	-	-	-	-	-	-	-	-	-	-	R(1)/pc3/1(gr)/c3(dr)	-	-
121*	5660	10/27/02	-	-	-	-	-	-	-	-	-	-	R(1)/cu1/1(gr)/c2(dr)	-	-
122*	5663	10/27/02	-	-	-	-	-	-	-	-	-	-	R(1)/cu2/1(gr)/c2(dr)	-	-
123*	5626	10/26/02	-	-	-	-	-	-	-	-	-	-	C(2)/cu3/1(pa)/c2, c3(dr)	-	-
124*	5668	10/27/02	-	-	-	-	-	-	-	-	clear	slow-medium	R(1)/cu2/1(pa)/c1	abundant	-

•=sites with land snails

◆=not shown on 7.5' map

□=measurements not possible because flow was entirely boxed/piped or water too shallow, it was dry, or collected previous to this project

Habitat:

R=rheocene (spring discharge in defined channel)

L=limnocrene (spring discharge into a pond or pool)

H=helocene (spring similar to limnocrene, but marshy and comparatively shallow, not open pond or pool)

A=artesian

C=creek

R=river

In parentheses;

1=small

2=medium

3=large

s=spring influenced

Modifications:

no=none

pc1=pump chance above spring source

pc2=pump chance at spring source

pc3=pump chance below spring source

wt1=entire spring flow diverted to water tank

wt2=part of spring flow diverted to water tank

tr1=entire spring flow diverted to trough

tr2=part of spring flow diverted to trough

pl1=entire flow of spring piped

pl2=part of spring flow piped

bx1=spring source completely boxed

bx2=spring source partially boxed

df=spring converted into a drinking fountain or faucet

ca=spring capped

cu1=culvert above spring source

cu2=spring run with culvert below source

cu3=creek/river with culvert

br=bridge

cg=campground

Modifications (cont.):

d1=spring flow entirely diverted into ditch/canal

d2=spring flow partially diverted into ditch/canal

d3=spring run diverted by roadside ditch to culvert

d4=spring ditched at source

f1=wooden fence

f2=barb wire fence

f3=barbless wire fence

f4=stone wall

rf=road ford across spring/stream/river channel

rt=trail ford across spring/stream/river channel

mi=impact from mining

In parentheses;

co=concrete

wo=wood

pl=plastic

me=metal

ab=modifications abandoned

in=fence/wall not intact or in disrepair

Access:

1= road within 200 m

2= road not within 200 m

tr=trail

In parentheses;

pa=paved (concrete or asphalt)

gr=gravel

di=dirt

4=4WD road

a=road above

b=road below

Connect (Connectivity to Drainage Basin):

c1=well connected to the drainage by permanent stream channel

c2=connected by impermanent stream channel

c3=not well connected to the drainage (topography shows no obvious stream channel)

c4=in a basin with no outlet

In parentheses;

dr=dry

TABLE 2. SITE OWNERSHIP.

OWNER	SITES
Lassen National Forest (total 60 (12 <i>Fluminicola</i> ; 11 <i>Juga</i> ; 35 without mollusks; 43 springs; 7 spring influenced; 8 dry))	6+ , [7]*+, 9 , 10 , 20- , 21- , 22-, 23-, 24- , 25-, 26- , [27]-, 28-, 32 , <u>33-</u> , <u>34-</u> , <u>35-</u> , 36*+ , 37*+ , 38*+ , [39], 40- , 41- , 42- , 43- , 45+ , 46+ , 47- , [48]-, [49]-, 50- , 55- , 56* , [57]+, 60+ , [62]-, 63 , 64 , 65- , 66*+ , 67* , 68- , 69+, 70-, 71* , 76- , 77 , 78* , 80-, 81* , 82* , 83-, 84-, 93 , 117- , 118- , <u>119-</u> , 120- , 121- , 122- , 124*
Lassen National Forest inholding (total 17 (5 <i>Fluminicola</i> ; 4 <i>Juga</i> ; 9 without mollusks; 15 springs; 1 dry))	8 , 11- , 29- , 30- , 31- , 44-, 51*+ , 52* , 53- , 54- , 58*+ , 59- , 61+ , 79+ , 91* , 92* , <u>123-</u>
Shasta-Trinity National Forest (administered by Lassen National Forest) (total 5 (1 <i>Juga</i> ; 4 without mollusks; 4 springs; 1 spring influenced; 1 dry))	1- , 2- , <u>3-</u> , 4- , [5]+
Plumas National Forest (total 24 (9 <i>Fluminicola</i> ; 2 <i>Juga</i> ; 10 without mollusks; 17 springs; 1 spring influenced; 2 dry))	72* , 73+, 74-, 75-, 95- , 96* , <u>97-</u> , 98* , 99* , 100* , 101- , 102* , 103* , 104 , 105- , 106, 107 , 108- , 109* , 110* , 111- , 112- , [113]+, <u>115-</u>
Plumas National Forest inholding (total 1 (1 without mollusks; 1 spring))	114-
Lassen Volcanic National Park (total 6 (2 <i>Fluminicola</i> ; 2 <i>Juga</i> ; 3 without mollusks; 6 springs))	85*+ , 86- , 87+ , 88* , 89- , 90-
Latour Demonstration State Forest (total 5 (2 <i>Fluminicola</i> ; 3 without mollusks; 4 springs))	12- , 13- , 18* , 19* , 116-
other (total 5 (2 <i>Fluminicola</i> ; 1 <i>Juga</i> ; 2 without mollusks; 5 springs))	14- , 15 , 16*+ , 17* , 94-

*=sites with *Fluminicola* present (total 32)

+ =sites with *Juga* present (total 21)

- =sites without mollusks present (total 67)

bold=sites that are springs (total 95)

[] =sites that are spring influenced (total 9)

underline=dry sites (total 12)

TABLE 3. MUSEUM RECORDS.

INSTITUTION & CAT. NO.	NO. OF SPECS.	LOCALITY & COLLECTOR	OUR ID	LAND OWNERSHIP
ANSP: Academy of Natural Sciences of Philadelphia				
27533	many	Eagle Lake [Lassen Co.], R. E. C. Stearns!	<i>Juga acutifilosa</i>	?
27556	2	Feather R., Unknown!	<i>Juga n. sp.</i>	?
27568	5	Table Mnt., Butte Co. [sec. 33, T25N R5E], Unknown!	<i>Juga n. sp.</i>	Lassen NF
73510	10	E. Fk. Feather R. [sic: Mill Cr?] Morgan Spr., Plumas Co., R. C. McGregor! 1898	<i>Juga n. sp.</i>	Lassen NF inholding?
73512	30	W. Fk. Feather [sic: Mill Cr?], Morgan Spring, Plumas Co., R. C. McGregor! 1898	<i>Juga n. sp.</i>	?
73514	8	Small creek, Eagle Lake, Lassen Co., R. C. McGregor! 1898	<i>Juga acutifilosa</i>	?
A6044B	2	as above	<i>Juga acutifilosa</i>	?
73518	?	Small spring at Eagle Lake, Lassen Co., R. C. McGregor!	<i>Juga n. sp.</i>	?
73522	12	Battle Cr., 10 mi. above mouth, Shasta Co., R. C. McGregor! 1898	<i>Juga n. sp.</i>	private?
105056	1	Paradise, Butte Co., J. Rowell!	<i>Juga n. sp.</i>	private?
114784	3	Spring on Placerville Road, H. N. Lowe! 1916	<i>Juga n. sp.</i>	private?
125085	15	N. Fk. Yuba R., Downieville [Sierra Co.], Unknown!, ex. C. M. Wheatley collection	<i>Juga n. sp.</i>	Tahoe NF inholding?
212242	20	Butterfly Cr., near Keddie, [Plumas Co.], Chace, H. N. Lowe!	<i>Juga n. sp.</i>	Plumas NF inholding?
73509	18	E. Fk. of Feather R. [sic], Plumas Co., R. C. McGregor! 10/18/1898	<i>Fluminicola n. sp.</i>	?
CAS: California Academy of Sciences				
unnumbered	6	Estray Cr., Plumas Co., W. I. Folett!, 2/7/1969	<i>Juga n. sp.</i>	Plumas NF inholding?
unnumbered	4	Emigrant Gap, Plumas Co., J. Keep!	<i>Juga n. sp.</i>	Tahoe NF inholding
unnumbered	2	Indian Valley above Quincy, Plumas Co., J. Keep!	<i>Juga n. sp.</i>	private?
unnumbered	many	Willow Creek, upper meadow [Lassen Co.], Hanna! 4/19/1958	<i>Juga acutifilosa</i>	private?
20329	12	Mill Cr., Morgan Springs, Tehama Co., W. F. Barbot!	<i>Juga n. sp.</i>	Lassen NF inholding
20329	7	Mill Cr. at Morgan Cr. [sic], Tehama Co., W. F. Barbot!	<i>Juga n. sp.</i>	?
20337	7	Deer Cr. Meadows, Deer Cr., Tehama Co., W. F. Barbot!	<i>Juga n. sp.</i>	Lassen NF inholding
20345a	20	Devils Kitchen [Lassen Volcanic National Park], SW sec. 21, T30N R5E, W. F. Barbot!	<i>Juga n. sp.</i>	Lassen Vol. Nat. Park
20348	many	N. [sic: E. or W.?] Br. of N. Fk. Feather R., Plumas Co., W. F. Barbot!	<i>Juga n. sp.</i>	?
30037	?	Murrers Upper Meadow, Willow Creek [Willow Creek Spring, near Eagle Lake, (E. side of lake), Lassen Co., A. G. Smith! 9/1958	<i>Juga acutifilosa</i>	private?
32000	5	Paynes Cr. "Rocky Plain", Tehama Co., H. Hannibal!	<i>Juga n. sp.</i>	?
36970	many	½ mi. N. Willow Cr. Forest Service Camp, hwy. 139, ca. 13.5 mi. S. of Adin [Lower McBride Springs, Lassen Co.], G. D. Hanna & C. W. Chesterman! 10/3/1960	<i>Juga n. sp.</i>	Modoc NF

TABLE 3. MUSEUM RECORDS (cont.).

INSTITUTION & CAT. NO.	NO. OF SPECS.	LOCALITY & COLLECTOR	OUR ID	LAND OWNERSHIP
CAS: California Academy of Sciences (cont.)				
37774	15 topo	Willow Creek, upper meadow [Lassen Co.], A. G. Smith!	<i>Juga acutifilosa</i>	private?
50122	6	Indian Valley above Quincy, Plumas Co., J. Raymond!	<i>Juga n. sp.</i>	private?
112152	?	Washington Creek, Nevada Co., Tahoe National Forest, E. J. Kools! 8/28/1997	<i>Juga n. sp.</i>	Tahoe NF
113099	?	1 mi. S. of Washington, East Fork Creek, Nevada Co., Tahoe National Forest, E. J. Kools! 8/22/1997	<i>Juga n. sp.</i>	Tahoe NF
113100	?	E. of Washington along Maybert Road, Golden Quartz picnic area, on rocks in river, S. Fork Yuba River, Tahoe National Forest, Nevada Co. E. J. Kools! 8/28/1997	<i>Juga n. sp.</i>	Tahoe NF
157694	?	Lost Creek, Lassen National Forest, Shasta Co., J. Brim Box! 7/16/2001	<i>Juga n. sp.</i>	Lassen NF
165368	?	Deer Creek at lower falls, off Forest Service Road 27N08, approx. 13 air mi. S. of Mineral, Lassen National Forest, Tehama Co., J. Brim Box! 7/24/2001	<i>Juga n. sp.</i>	Lassen NF
165371	?	Soldier Creek, Lassen National Forest, Plumas Co., J. Brim Box! 7/25/2001	<i>Juga n. sp.</i>	Lassen NF
165372	?	Deer Creek at lower falls, off Forest Service Road 27N08, approx. 13 air mi. S. of Mineral, Lassen National Forest, Tehama Co., J. Brim Box! 7/24/2001	<i>Juga n. sp.</i>	Lassen NF
165953	?	Domigo Springs off CR Route 311, (approx. 7 air miles NW of Chester), Lassen National Forest, Plumas Co., J. Brim Box! 6/19/2001	<i>Juga n. sp.</i>	Lassen NF
166011	?	Deer Creek off St. Rt. 32, ca. 11 air mi. S. of Mineral, Lassen National Forest, Tehama Co., J. Brim Box! 7/23/2001	<i>Juga n. sp.</i>	Lassen NF
166013	?	Unnamed spring off Country Rd 769 c. 0.4 mi E of CA Rt 36/89, c. 13 air mi WNW of Chester, Lassen National Forest, Tehama Co., J. Brim Box! 7/23/2001	<i>Juga n. sp.</i>	Lassen NF
166361	?	Deer Creek off St. Rt. 32 0.5 mi. N. of Alder Creek Campsite, ca. 11 air mi. SE of Mineral, Lassen National Forest, Tehama Co., J. Brim Box! 7/23/2001	<i>Juga n. sp.</i>	Lassen NF
93777	?	Burney Falls, pool [Sta. 14b], Shasta Co., A. G. Smith! 1/1963	<i>Fluminicola seminalis</i>	State of CA
93832	?	Clear Creek 3 mi. W. of Westwood on road to Quincy, Plumas Co., G. D. Hanna! 10/4/1946	<i>Fluminicola n. sp.</i>	?
93833	?	same as above	<i>Fluminicola n. sp.</i>	?
93835	21	Domingo Spring, Plumas Co., W. F. Barbot!	<i>Fluminicola n. sp.</i>	Lassen NF
93836	?	Rivulet near monument, Donner Lake, Placer [Nevada] Co., A. G. Smith! 7/19/1947	<i>Fluminicola n. sp.</i>	State of CA?
93837	21	E. side of Donner Lake, spring near highway, Nevada Co., A. G. Smith!	<i>Fluminicola n. sp.</i>	State of CA
93844	170	E. side of Donner Lake, Donner Mounument, spring near highway, Nevada Co., A. G. Smith! 8/8/1940	<i>Fluminicola n. sp.</i>	State of CA
93847	39	Cold Creek near Westwood, Lassen Co., CA	<i>Fluminicola n. sp.</i>	?

TABLE 3. MUSEUM RECORDS (cont.).

INSTITUTION & CAT. NO.	NO. OF SPECS.	LOCALITY & COLLECTOR	OUR ID	LAND OWNERSHIP
CAS: California Academy of Sciences (cont.)				
93848	34	Willow Creek, Murrer's Upper Meadow, springs and small creek, NE 1/4 sec. 26, T.32N, R.11E (MDM), near Eagle Lake, Lassen Co., CA	<i>Fluminicola</i> n. sp.	?
93850	12	Butte Creek near Jonesville, Butte Co.	<i>Fluminicola</i> n. sp.	?
93852	?	Near forest service station, Mineral, Tehama Co., W. F. Barbot!	<i>Fluminicola</i> n. sp.	Lassen NF
93853	24	Jonesville, Butte Co., McClellan! 9/20/1923	<i>Fluminicola</i> n. sp.	?
93854	5	Colby Creek near Jonesville, Butte Co., W. F. Barbat!	<i>Fluminicola</i> n. sp.	?
93856	75	Donner Lake, rivulet near monument, Placer [sic; Nevada] Co., A. G. Smith! 7/19/1947.	<i>Fluminicola</i> n. sp.	State of CA
93858	60	Lake Tahoe, Placer Co., J. Keep!	<i>Fluminicola</i> n. sp.	?
37774	many	Murrers Upper Meadow, Willow Creek, Lassen Co. G. D. Hanna, A. G. Smith, C. W. Chesterman, G. C. G! 9/19/1958	<i>Pyrgulopsis</i> <i>eremica</i>	Private?
165981	?	Lost Creek, Lassen National Forest, Lassen Co., J. Brim Box! 7/16/2001	<i>Lanx</i> <i>patelloides</i>	Lassen NF
SBMNH: Santa Barbara Museum of Natural History				
unnumbered	-	Butte Cr. Canyon 10 mi. from Chico, L. D. Ingles! 1/14/1933, ex. S. S. Berry 7437	<i>Juga</i> n. sp.	private?
unnumbered	-	N. Fk. Feather R., Plumas Co., L Shapovalov! 11/2/32, ex. S. S. Berry 7419	<i>Juga</i> n. sp.	?
unnumbered	many	Upper Martis Valley, Plumas Co., A. G. Smith! 7/28/1947, ex. A. G. Smith 2978a, ex. S. S. Berry 6836	<i>Fluminicola</i> n. sp.	?
unnumbered	many	Rivulate near Donner Monument, Nevada Co., sec. 17, T17N R16E, A. G. Smith! 7/19/1947, ex. A. G. Smith 8646, ex. S. S. Berry 14764	<i>Fluminicola</i> n. sp.	State of CA
unnumbered	many	Ice-cold spring at Polaries, Nevada Co., sec. 7, T17N R17E, A. G. Smith! 6/30/1927, ex. A. G. Smith 2971, ex. S. S. Berry 6837	<i>Fluminicola</i> n. sp.	?
unnumbered	many	Small rill running into Donner Lake [Nevada Co.], A. G. Smith! 5/30/1916, ex. A. G. Smith 3778, ex. S. S. Berry 3778	<i>Fluminicola</i> n. sp.	?
8587	4	Mill Creek, 4.5 mi. above mouth, Tahoma Co., L. Shapovalov! 8/5/1937	<i>Lanx</i> <i>patelloides</i>	?
UCM: University of Colorado Museum of Zoology				
1687	36	Paine's [sic; Paynes] Cr., Rocky Plains, Unknown! Summer 1933	<i>Juga</i> n. sp.	?
21730	many	Troxel Spring, Eagle Lake, CA	<i>Juga</i> n. sp.	
21746	31	Feather R., Camp Rodgers [Plumas Co.], E. P. Chace!	<i>Juga</i> n. sp.	
21747	12	Small creek flowing into Feather R., 4 mi. below Belden [Plumas Co.], E. P. Chace!	<i>Juga</i> n. sp.	
21749	6	Feather R., Camp Rodgers, E. P. Chace!	<i>Juga</i> n. sp.	

TABLE 3. MUSEUM RECORDS (cont.).

INSTITUTION & CAT. NO.	NO. OF SPECS.	LOCALITY & COLLECTOR	OUR ID	LAND OWNERSHIP
UCM: University of Colorado Museum of Zoology (cont.)				
21751	4	Emigrant Pass, Placer Co., H. Hannibal!	<i>Juga</i> n. sp.	
23211	many	Near Keddie [Plumas Co.], E. P. Chace!	<i>Juga</i> n. sp.	
24329	2	Near Keddie, Plumas Co., E. P. Chace!	<i>Juga</i> n. sp.	
20267	40	Paines [sic; Paynes] Cr., Red Bluff, Manton Rd., Unknown! Summer 1933	<i>Fluminicola</i> "seminalis"	?
UMMZ: University of Michigan Museum of Zoology				
243559	many	Camp Rodgers from small creek flowing into Feather R., E. P. Chace! 1934	<i>Juga</i> n. sp.	
19723	3	Plumas Co., Stearns!	<i>Juga</i> n. sp.	?
62805	several	N. Fk. Feather R. above Chester, Plumas,	<i>Juga</i> n. sp.	?
134021	5	Spring near Eagle Lake, Lassen Co., H. Hannibal!	<i>Juga</i> <i>acutifilosa</i>	?
134022	several	Big Spring, Manton, Tehama Co., H. Hannibal!	<i>Juga</i> n. sp.	private
229450	many	Lassen Co., SE sec. 35, T32N R11E, 1300' W., 1600' N. of SE corner, spring in meadow [E. side of Willow Creek], D. W. Taylor! 10/10/1959	<i>Juga</i> <i>acutifilosa</i>	private?
229451	many	as above	<i>Juga</i> <i>acutifilosa</i>	private?
229584	many	Lassen Co., SE sec. 35, T32N R11E, 1500-2000' W., 1300' N. of SE corner, large spring-fed stream [Willow Creek], M. C. McKenna! 8/29/1950	<i>Juga</i> <i>acutifilosa</i>	private?
229588	many	as above	<i>Juga</i> <i>acutifilosa</i>	private?
229589	many	Lassen Co., NE [sic: SE?] sec. 35, T32N R11E, 600-700' W., 100-400' S. of NE corner, spring on E. side of Willow Creek, D. W. Taylor! 10/11/1959	<i>Juga</i> <i>acutifilosa</i>	private?
229590	many	Willow Creek, Lassen Co., NE [sic: SE?] sec. 35, T32N R11E, D. W. Taylor! 10/10/1959	<i>Juga</i> <i>acutifilosa</i>	private?
229591	many	as above	<i>Juga</i> <i>acutifilosa</i>	private?
243548	6	Butterfly Creek near Kiddie [sic: Keddie], Plumas Co., Feather R. drainage, E. P. Chace! 1934	<i>Juga</i> n. sp.	?
300203*	several	Lassen Volcanic National Park, Shasta Co.	<i>Juga</i> n. sp.	LVNP
60000	3	Susan River, at US 395 approx. 40.377537°N, 120.39553°W, Lassen Co. C. L. Hubbs, 7/4/1942	<i>Andonta</i> <i>californinesis</i>	?
USNM: National Museum of Natural History (Smithsonian Institution)				
60596	1 Type	Eagle Lake [most likely Willow Creek, Lassen Co.], H. W. Henshaw!	<i>Juga</i> <i>acutifilosa</i>	private?
60596	14 Para	as above	<i>Juga</i> <i>acutifilosa</i>	private?

*=2 specimens from this lot were DNA sampled (Lee, T. *et al.*, 2006)

TABLE 4. SIERRA NEVADA NATIONAL FORESTS FAUNAL LIST.

TAXON NAME	SITE NUMBERS												
	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	x	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Juga</i> n. spp.	-	-	-	-	x	x	x	-	-	-	-	-	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella (P.) gyrina</i>	-	-	-	-	-	x	-	-	-	-	-	-	-
<i>Fossaria (F.) modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	x?	-	-	-	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	x?	-	-	x	x?	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
TAXON NAME	SITE NUMBERS												
	14	15	16	17	18	19	20	21	22	23	24	25	26
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	x	x	x	x	-	-	-	-	-	-	-
<i>Juga</i> n. spp.	-	-	x	-	-	-	-	-	-	-	-	-	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella (P.) gyrina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fossaria (F.) modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	x	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 4. SIERRA NEVADA NATIONAL FORESTS FAUNAL LIST.

TAXON NAME	SITE NUMBERS												
	27	28	29	30	31	32	33	34	35	36	37	38	39
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	X	X	X	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Juga</i> n. spp.	-	-	-	-	-	-	-	-	-	X	X	X	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella</i> (P.) <i>gyrina</i>	-	-	-	-	-	X	-	-	-	-	-	-	-
<i>Fossaria</i> (F.) <i>modicella</i>	-	-	-	-	-	x?	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	x?	-	-	-	-	-	-	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-	-	-	-	-	-	X
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

TAXON NAME	SITE NUMBERS												
	40	41	42	43	44	45	46	47	48	49	50	51	52
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	-	-	-	-	-	-	-	-	-	X	X
<i>Juga</i> n. spp.	-	-	-	-	-	X	X	-	-	-	-	X	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella</i> (P.) <i>gyrina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fossaria</i> (F.) <i>modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	-	x?	-	-	-	-	-	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 4. SIERRA NEVADA NATIONAL FORESTS FAUNAL LIST (cont.).

TAXON NAME	SITE NUMBERS												
	53	54	55	56	57	58	59	60	61	62	63	64	65
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	-	X	-	X	-	-	-	-	-	-	-
<i>Juga</i> n. spp.	-	-	-	-	X	X	-	X	X	-	-	-	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella</i> (P.) <i>gyrina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fossaria</i> (F.) <i>modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	-	-	-	-	-	-	X	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-	-	-	-	X	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
TAXON NAME	SITE NUMBERS												
	66	67	68	69	70	71	72	73	74	75	76	77	78
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	X	X	-	-	-	X	X	-	-	-	-	-	X
<i>Juga</i> n. spp.	X	-	-	X	-	-	-	X	-	-	-	-	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella</i> (P.) <i>gyrina</i>	x?	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fossaria</i> (F.) <i>modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vorticifex effusus</i>	X	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	-	-	-	-	-	-	x?	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 4. SIERRA NEVADA NATIONAL FORESTS FAUNAL LIST (cont.).

TAXON NAME	SITE NUMBERS												
	79	80	81	82	83	84	85	86	87	88	89	90	91
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	X	X	-	-	X	-	-	X	-	-	X
<i>Juga</i> n. spp.	X	-	-	-	-	-	X	-	X	-	-	-	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella</i> (P.) <i>gyrina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fossaria</i> (F.) <i>modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
TAXON NAME	SITE NUMBERS												
	92	93	94	95	96	97	98	99	100	101	102	103	104
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	X	-	-	-	X	-	X	X	X	-	X	X	-
<i>Juga</i> n. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Physella</i> (P.) <i>gyrina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fossaria</i> (F.) <i>modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	X	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	X	X	X	X	-
<i>Pisidium casertanum</i>	-	X	-	-	-	-	X	X	X	X	X	X	X
<i>Pisidium dubium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	X	-

TABLE 4. SIERRA NEVADA NATIONAL FORESTS FAUNAL LIST (cont.).

TAXON NAME	SITE NUMBERS												
	105	106	107	108	109	110	111	112	113	114	115	116	117
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	-	-	X	X	-	-	-	-	-	-	-
<i>Juga</i> n. spp.	-	-	-	-	-	-	-	-	X	-	-	-	-
<i>Valvata humeralis</i>	-	X	-	-	-	-	-	-	-	-	-	-	-
<i>Physella (P.) gyrina</i>	-	X	-	-	-	-	-	-	-	-	-	-	-
<i>Fossaria (F.) modicella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	X	-	-	-	-	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	X	X	-	X	-	-	-	-	-	-	-	-
<i>Pisidium dubium</i>	-	X	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

TAXON NAME	SITE NUMBERS						
	118	119	120	121	122	123	124
<i>Fluminicola ahjumawi</i>	-	-	-	-	-	-	-
<i>Fluminicola caballensis</i>	-	-	-	-	-	-	-
<i>Fluminicola</i> n. spp.	-	-	-	-	-	-	-
<i>Juga</i> n. spp.	-	-	-	-	-	-	-
<i>Valvata humeralis</i>	-	-	-	-	-	-	-
<i>Physella (P.) gyrina</i>	-	-	-	-	-	-	-
<i>Fossaria (F.) modicella</i>	-	-	-	-	-	-	-
<i>Stagnicola elodes</i>							-
<i>Vorticifex effusus</i>	-	-	-	-	-	-	-
<i>Musculium raymondi</i>	-	-	-	-	-	-	-
<i>Sphaerium patella</i>	-	-	-	-	-	-	-
<i>Pisidium casertanum</i>	-	-	-	-	-	-	-
<i>Pisidium dubium</i>	-	-	-	-	-	-	-
<i>Pisidium insigne</i>	-	-	-	-	-	-	-
<i>Pisidium variabile</i>	-	-	-	-	-	-	-